SUBJECT: MODBUS™ RTU & MODBUS™ TCP/IP COMMUNICATIONS & COMPONENTS

FYI #277 06/04/2018

Modbus™ RTU is an industrial communication protocol developed in 1979 used to establish master slave/client server communication between intelligent devices. It is the most widely used network protocol in the industrial manufacturing environment.

Modbus™ TCP/IP (Ethernet) is the common transport protocol of the Internet and Modbus™ TCP/IP can provide a reliable data transport mechanism between machines. Ethernet has become the standard of corporate enterprises and is becoming more common for factory networking. Using Ethernet TCP/IP in the factory allows true integration with the corporate Intranet and systems that support the factory.

For more information visit www.modbus.org.

ADVANTAGE has implemented Modbus™ RTU communication on Sentra Temptender, Sentra G, Sentra HE, Regal HE, Maximum HE and central chiller Multizone (MZC) instruments. The physical connection is made using the standard RS-485 port.

ADVANTAGE has also implemented Modbus™ TCP/IP on Sentra Temptender, Sentra G, Sentra HE, Regal HE instruments and central chiller Multizone (MZC). A circuit board is attached to the standard instrument to convert the Modbus™ RTU to Modbus™ TCP/IP. An industrial grade RJ45/IP67 connector is generally provided on the unit to easily connect to the plant network. A variety of connectors can be supplied to meet customer needs and facility standards.

The Modbus™ RTU and Modbus™ TCP/IP interface allows the instrument to communicate with a variety of devices including primary processing equipment controls, PLC's and many more. Modbus™ can communicate information including setpoint, retransmit of setpoint, actual temperature, deviation alarm, sensor failure and remote start/stop. (Remote start/stop via Modbus is not available on Multizone MZC instruments.)

The Modbus™ TCP interface can be configured to any user IP/Subnet. Configuration is achieved using a utility program that runs on Windows™ based PC's. Download at http://www.lantronix.com/products/deviceinstaller/. Refer to Advantage FYI #330 for installation instructions of the Lantronix utility.

Sentra Temptender

Sentra G Series

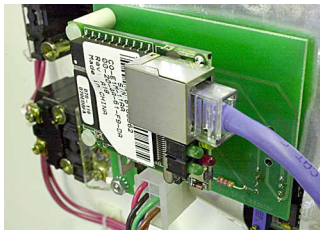
Sentra HE

Regal HE

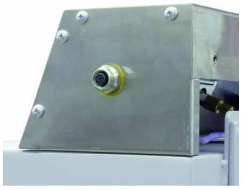
Maximum HE


Multizone MZC


Advantage instrument with Modbus™ TCP/IP add-on circuit board.


Close up view of the Modbus™ TCP/IP connection and circuit board.

RS-485 communications port used on Advantage Instruments for SPI and Modbus™ RTU communications.


Example of industrial grade RJ45/IP67 port connection for Modbus™ TCP/IP network interface.

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Modbus / TCP Register Definitions for Sentra Temptender, Sentra G and Sentra HE

Rev 1.1

	Register	Coil	Use	Range	Units	Notes
Temperature Setpoint	1		R/W	0-250	F	
Temperature Setpoint 2	2		R/W	0-250	F	
Temperature High Alarm	3		R/W	0-50	F	
Temperature Low Alarm	4		R/W	0-50	F	Deviation Value
Flow Low Alarm	5		R/W	0-99	GPM	Deviation Value
To Process Temperature	6		R	0-255	F	
From Process Temperature	7		R	0-255	F	
To Process Flow Rate	8		R	0-99	GPM	

Notes:

IP Address	200.0.0.203 (typical)
Subnet Mask	255.255.255.0
Gateway	none
SKT, SKG, SKHE Protocol	RTU
SKT, SKG, SKHE Address	1
SKT, SKG, SKHE Baud Rate	96

The following Modbus/TCP communication functions are supported.

0X Commands	FC1 - Read Coils
1X Commands	FC2 - Read Inputs
4X Commands	FC3 - Read holidng registers
3X Commands	FC4 - Read input registers
0X Commands	FC5 - Write Coil
4X Commands	FC5 - Write single register
4X Commands	FC16 - Write multiple register

Process Status — Register 9 — Coil 1 - 16 — Use R

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
						Lo Flow				Lo Temp	Hi Temp.	Alarm Machine	Alarm Process	Alarm	Pump On

Machine Status 1 — Register 10 — Coil 17 - 32 — Use R

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Phase Wrong	Heater Fail	Pump O/L			Lo Flow		Lo Press		Lo Temp	HTL Switch	Alarm Machine	Alarm Process	Alarm	Pump On

Machine Status 2 — Register 11 — Coil 33 - 48 — Use R

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
											Sensor Fail	Alarm Machine	Alarm Process	Alarm	Pump On

Reserved	12	49 - 64	R
Reserved	13	65 - 80	R
Reserved	14	81 - 96	R

Heartbeat - Value is period On followed by period Off — Register 15 — Coil 97 - 112 — Use R

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
											16 second				1 second (coil 97)

Machine control — Register 16 — Coil 113 - 128 — Use R/W

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
														Alarm Ack.	Machine ON / OFF

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Modbus / TCP Register Definitions for Regal HE

Rev 1.1

	Register	Coil	Use	Range	Units	Notes
Temperature Setpoint	1		R/W	32-500	F	
Unused	2					
Temperature High Alarm	3		R/W	0-30	F	Deviation Value
Temperature Low Alarm	4		R/W	0-30	F	Deviation Value
Unused	5					
To Process Temperature	6		R	32-500	F	
From Process Temperature	7		R	32-500	F	
Unused	8					

Notes:

IP Address	200.0.0.203 (typical)
Subnet Mask	255.255.255.0
Gateway	none
Regal HE Protocol	RTU
RKHE Address	1
RKHE Baud Rate	96

The following Modbus/TCP communication functions are supported.

0X Commands	FC1 - Read Coils
1X Commands	FC2 - Read Inputs
4X Commands	FC3 - Read holidng registers
3X Commands	FC4 - Read input registers
0X Commands	FC5 - Write coil
4X Commands	FC5 - Write single register
4X Commands	FC16 - Write multiple register

Process Status — Register 9 | Coil 1 - 16 | Use R

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
										Lo Temp	Hi Temp.	Alarm Machine	Alarm Process	Alarm	Pump On

Machine Status 1 — Register 10 | Coil 17 - 32 | Use R

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Phase Wrong		Pump O/L					Lo Press		Lo Temp	HTL Switch	Alarm Machine	Alarm Process	Alarm	Pump On

Machine Status 2 — Register 11 | Coil 33 - 48 | Use R

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
											Sensor Fail	Alarm Machine	Alarm Process	Alarm	Pump On

	Register	Coil	Use
Reserved	12	49 - 64	R
Reserved	13	65 - 80	R
Reserved	14	81 - 96	R

Heartbeat - Value is period On followed by period Off — Register 15 | Coil 97 - 112 | Use R

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
											16 second				1 second (coil 97)

Machine control — Register 16 | Coil 113 - 128 | Use R/W

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
														Alarm Ack.	Machine ON / OFF

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Modbus / TCP Register Definitions for Multizone III (MZC III) Instrument

Rev 1.1

	Register	Coil	Use	Range	Units	Notes	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Temperature Setpoint	1		R/W	0-250	F																	
Reserved	2																					
Temperature High Alarm	3		R/W	0-50	F	Deviation Value																
Temperature Low Alarm	4		R/W	0-50	F	Deviation Value																
Reserved	5																					
To Process Temperature	6		R	0-255	F																	
From Process Temperature	7		R	0-255	F																	
Reserved	8																					
Process Status	9	1 - 16	R														Low Temp	High Temp	Alarm Machine	Alarm Process	Alarm	0
Machine Status 1	10	17 - 32	R					Phase Wrong							Zone Low Pressure	Zone High Pressure	Zone Low Temp		Alarm Machine	Alarm Process	Alarm	0
Machine Status 2	11	33 - 48	R															Sensor Fail	Alarm Machine	Alarm Process	Alarm	0
Machine Status 3	12	49 - 64	R													Zone Off Pressure	Zone Comp Overload	Low Water Level	Alarm Machine	Alarm Process	Alarm	0
	13	65 - 80	R																			
	14	81 - 96	R																			
Heartbeat	15	97 - 112	R															16 Seconds				1 Second
Machine control	16	113 - 128	R/W																			
Zone 1 Temperature	17				F						Evaporator In								Evaporator Out			
Zone 2 Temperature	18				F						Evaporator In								Evaporator Out			
Zone 3 Temperature	19				F						Evaporator In								Evaporator Out			
Zone 4 Temperature	20				F						Evaporator In								Evaporator Out			
Zone 5 Temperature	21				F						Evaporator In								Evaporator Out			
Zone 6 Temperature	22				F						Evaporator In								Evaporator Out			
Zone 1 Status	23						1	LP Switch	Output 4	Output 3	Output 2	Output 1	Evaporator In Probe	Evaporator Out Probe	1	Zone On	Comp Overload	Low Oil Pressure	Freezestat	High Refrig Pressure	Low Refrig Pressure	Low Water Flow
Zone 2 Status	24						1	LP Switch	Output 4	Output 3	Output 2	Output 1	Evaporator In Probe	Evaporator Out Probe	1	Zone On	Comp Overload	Low Oil Pressure	Freezestat	High Refrig Pressure	Low Refrig Pressure	Low Water Flow
Zone 3 Status	25						1	LP Switch	Output 4	Output 3	Output 2	Output 1	Evaporator In Probe	Evaporator Out Probe	1	Zone On	Comp Overload	Low Oil Pressure	Freezestat	High Refrig Pressure	Low Refrig Pressure	Low Water Flow
Zone 4 Status	26						1	LP Switch	Output 4	Output 3	Output 2	Output 1	Evaporator In Probe	Evaporator Out Probe	1	Zone On	Comp Overload	Low Oil Pressure	Freezestat	High Refrig Pressure	Low Refrig Pressure	Low Water Flow
Zone 5 Status	27						1	LP Switch	Output 4	Output 3	Output 2	Output 1	Evaporator In Probe	Evaporator Out Probe	1	Zone On	Comp Overload	Low Oil Pressure	Freezestat	High Refrig Pressure	Low Refrig Pressure	Low Water Flow
Zone 6 Status	28						1	LP Switch	Output 4	Output 3	Output 2	Output 1	Evaporator In Probe	Evaporator Out Probe	1	Zone On	Comp Overload	Low Oil Pressure	Freezestat	High Refrig Pressure	Low Refrig Pressure	Low Water Flow

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